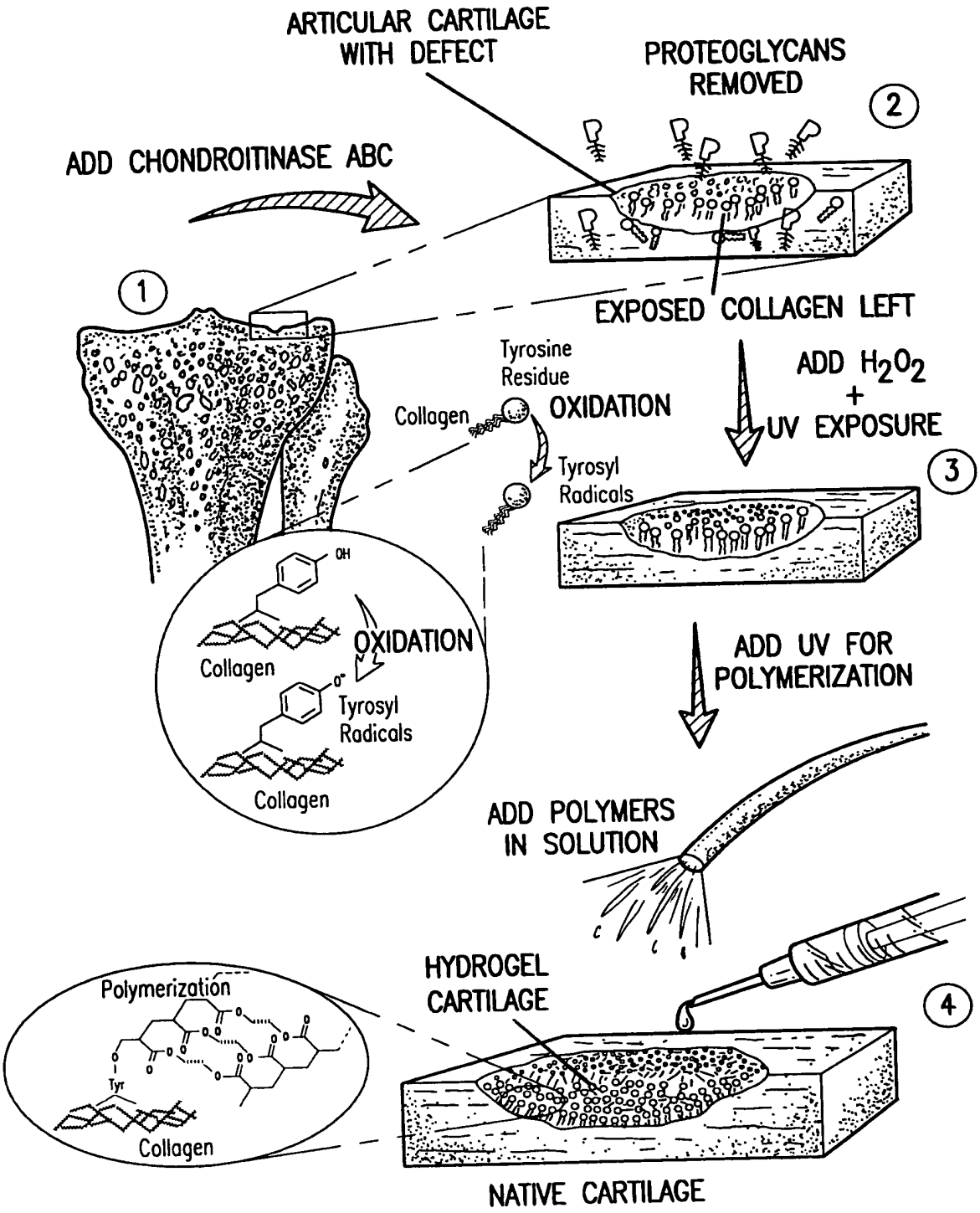
ARTICULAR CARTILAGE WITH DEFECT
PROTEOGLYCANS REMOVED
2
ADD CHONDROITINASE ABC
1
EXPOSED COLLAGEN LEFT
Tyrosine Residue
Collagen
OXIDATION
ADD H_2O_2 + UV EXPOSURE
Tyrosyl Radicals
3
OH
OXIDATION
Collagen
Tyrosyl Radicals
Collagen
ADD UV FOR POLYMERIZATION
ADD POLYMERS IN SOLUTION
HYDROGEL CARTILAGE
4
Polymerization
Tyr
Collagen
NATIVE CARTILAGE

FIG. 1

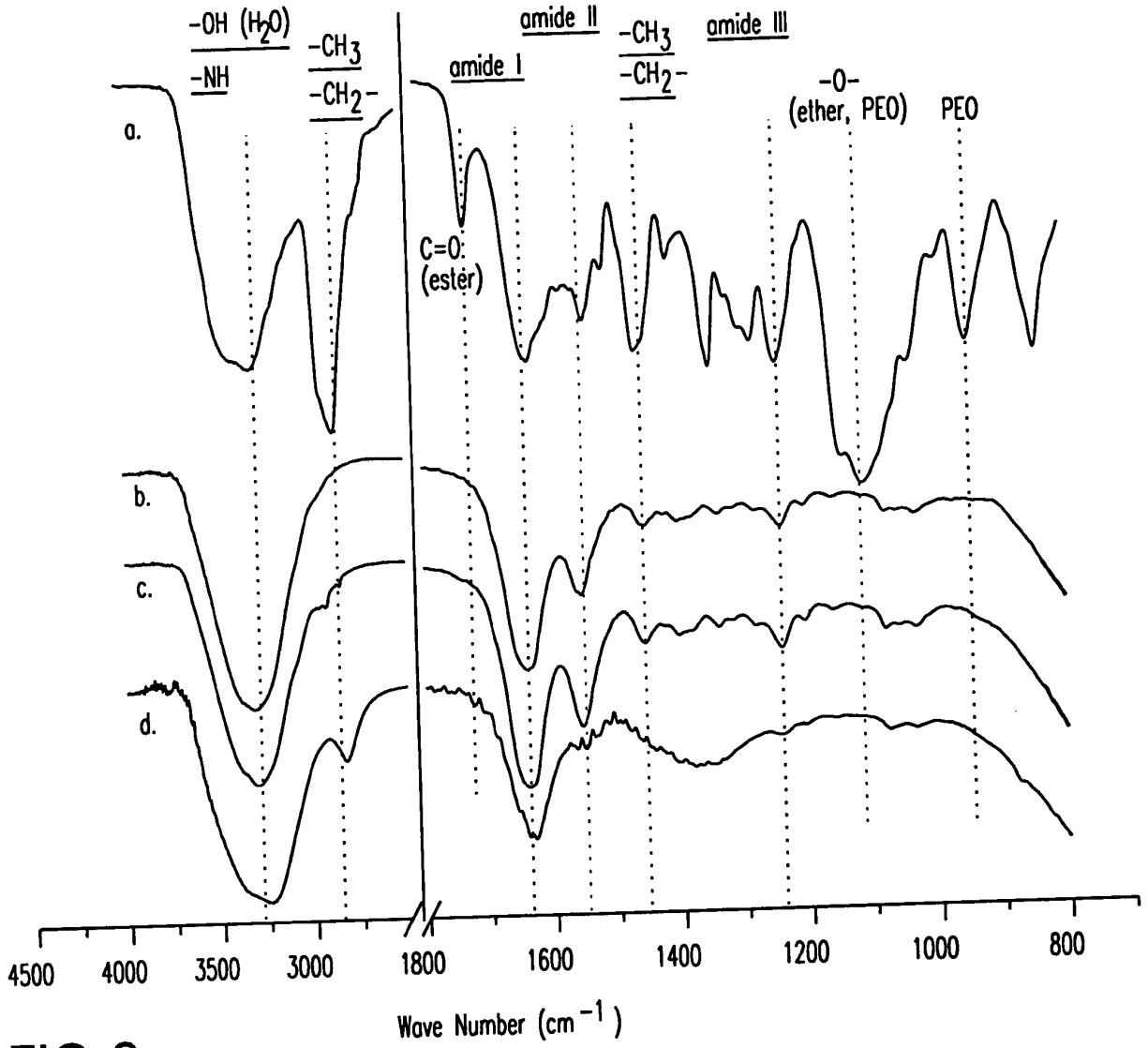
-OH (H_2O)
-NH
-CH_3
-CH_2-
amide I
amide II
-CH_3
-CH_2-
amide III
-O-
(ether, PEO)
PEO
C=O
(ester)
a.
b.
c.
d.
4500
4000
3500
3000
1800
1600
1400
1200
1000
800
Wave Number (cm^{-1})

FIG.2

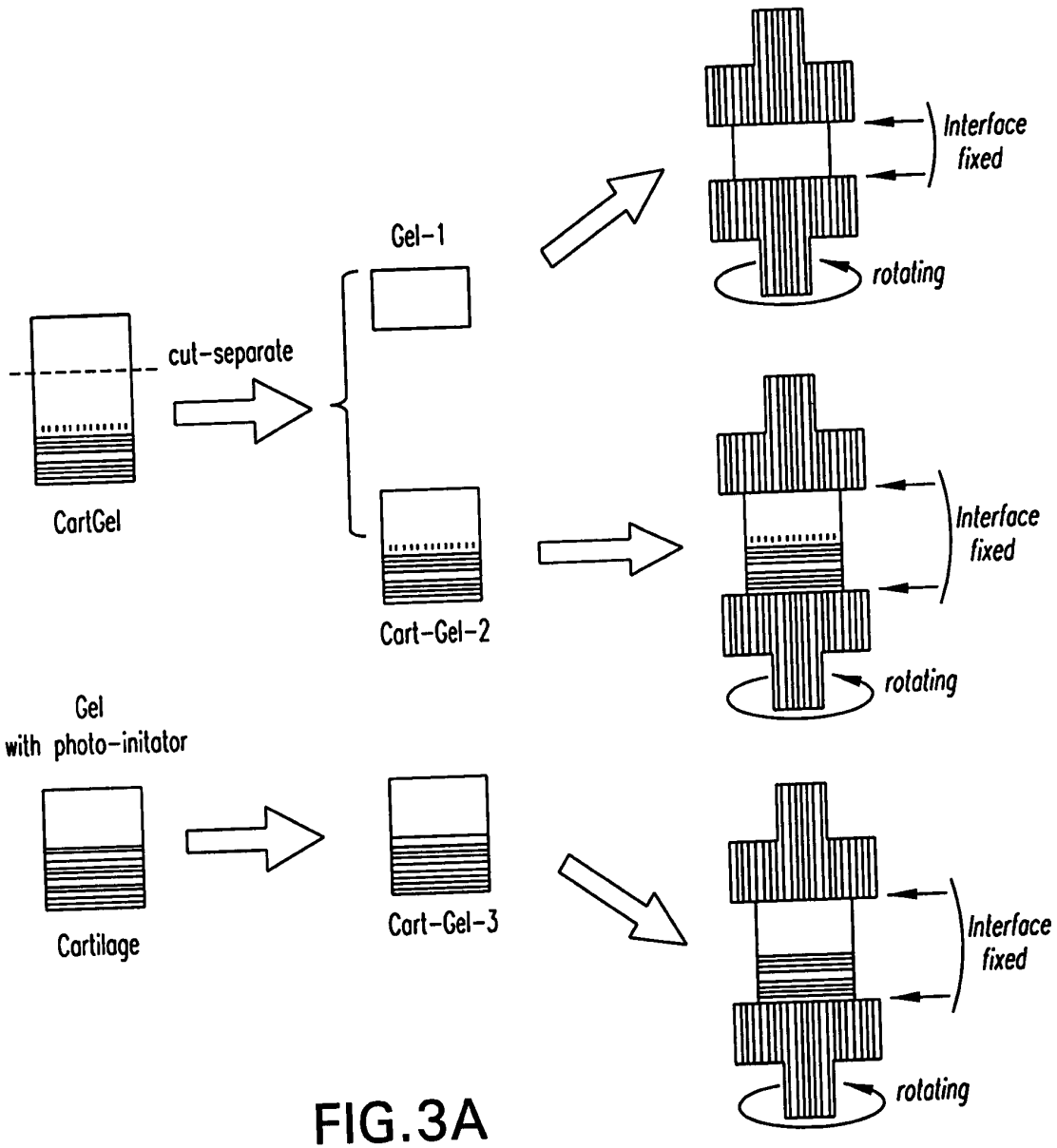
Gel-1
cut-separate
CartGel
Cart-Gel-2
Gel
with photo-initator
Cartilage
Cart-Gel-3
Interface
fixed
rotating
Interface
fixed
rotating
Interface
fixed
rotating

FIG.3A

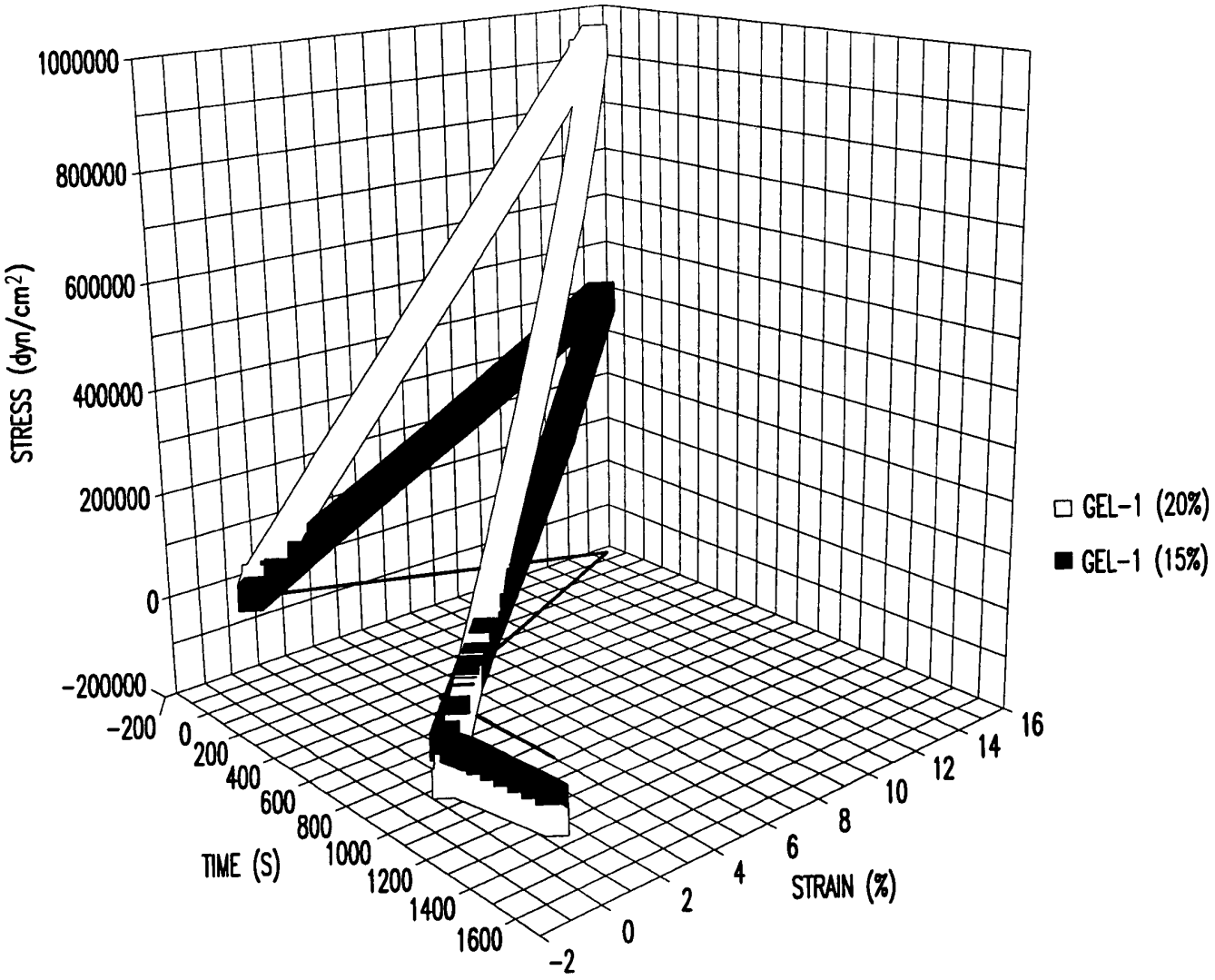
1000000
800000
600000
400000
200000
0
-200000
STRESS (dyn/cm²)
-200
0
200
400
600
800
1000
1200
1400
1600
TIME (S)
-2
0
2
4
6
8
10
12
14
16
STRAIN (%)
GEL-1 (20%)
GEL-1 (15%)

FIG.3B

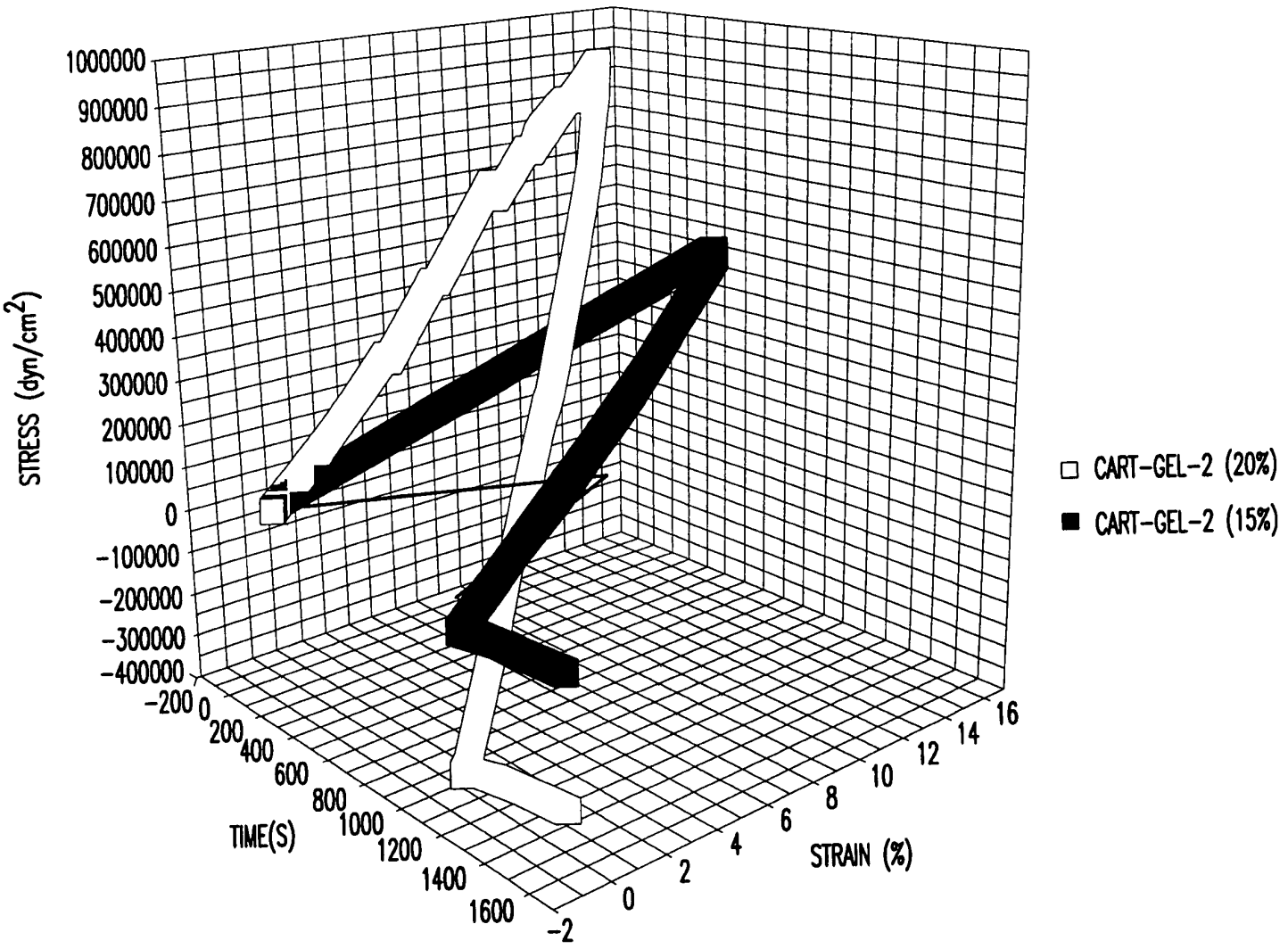
STRESS (dyn/cm2)
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
-200
0
200
400
600
800
1000
1200
1400
1600
TIME(S)
-2
0
2
4
6
8
10
12
14
16
STRAIN (%)
CART-GEL-2 (20%)
CART-GEL-2 (15%)

FIG.3C

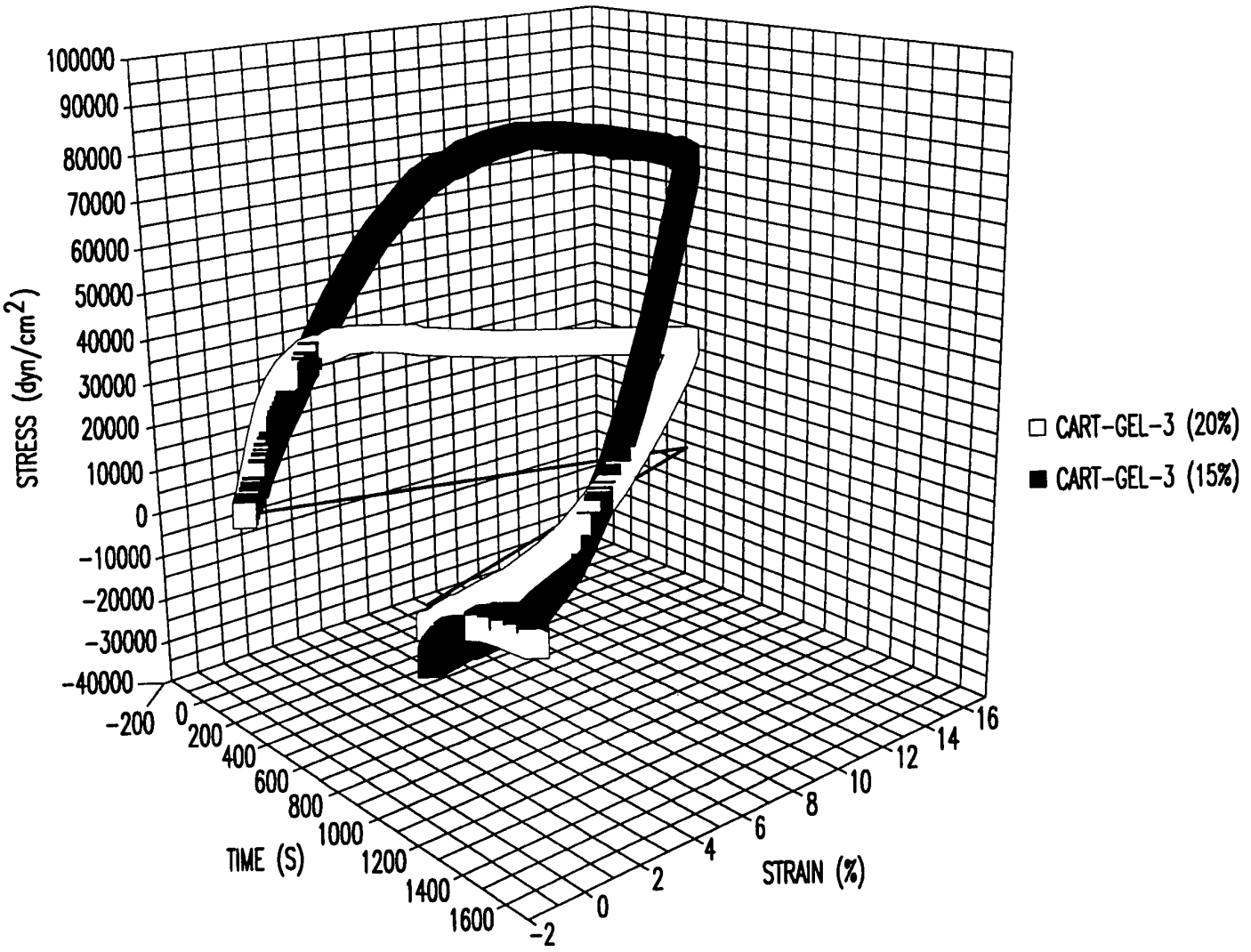
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
-10000
-20000
-30000
-40000
STRESS (dyn/cm2)
-200
0
200
400
600
800
1000
1200
1400
1600
TIME (S)
-2
0
2
4
6
8
10
12
14
16
STRAIN (%)
CART-GEL-3 (20%)
CART-GEL-3 (15%)

FIG.3D

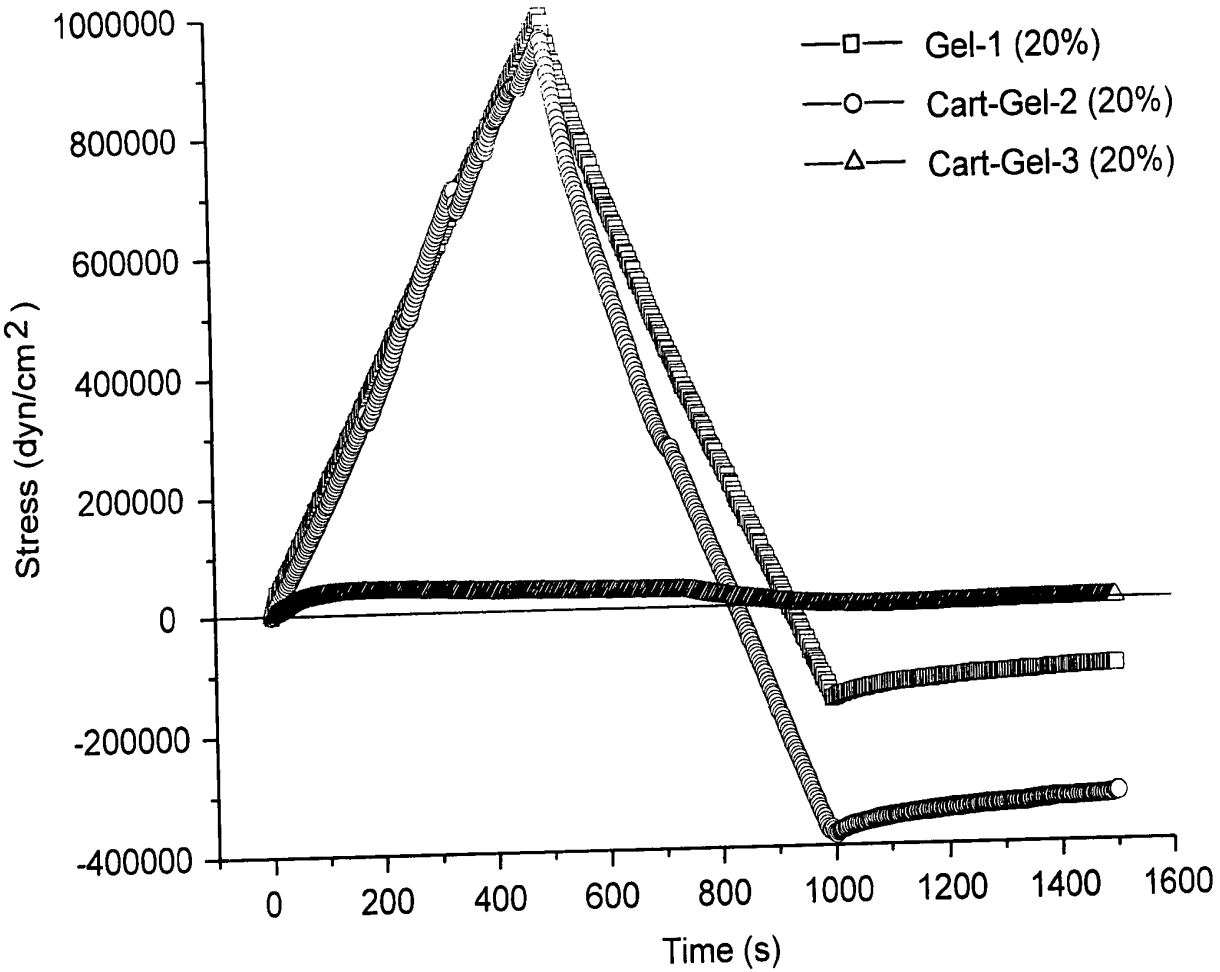
1000000
800000
600000
400000
200000
0
-200000
-400000
Stress (dyn/cm 2)
0
200
400
600
800
1000
1200
1400
1600
Time (s)
Gel-1 (20%)
Cart-Gel-2 (20%)
Cart-Gel-3 (20%)

FIG.3E

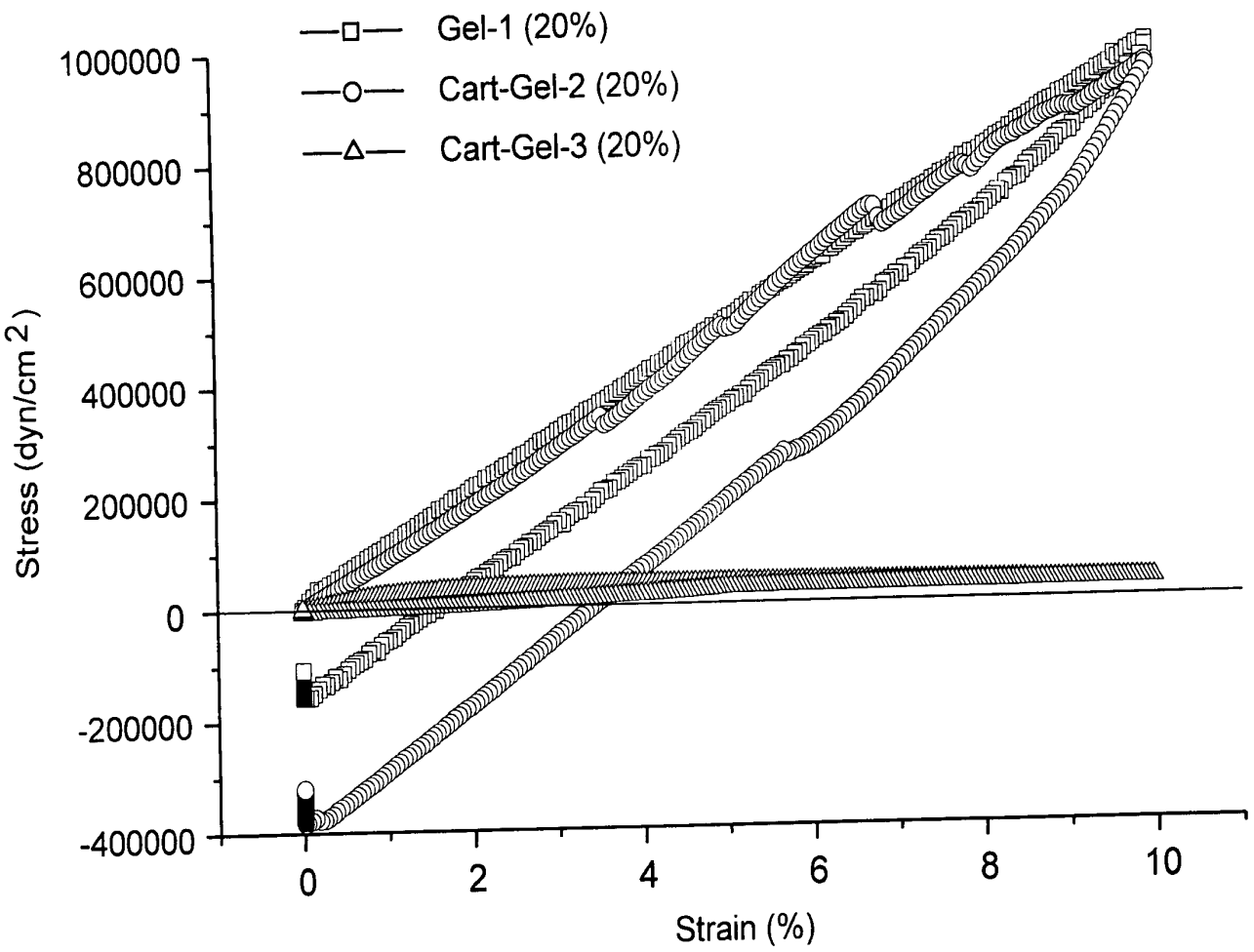
Gel-1 (20%)
Cart-Gel-2 (20%)
Cart-Gel-3 (20%)
1000000
800000
600000
400000
200000
0
-200000
-400000
Stress (dyn/cm 2)
0
2
4
6
8
10
Strain (%)

FIG.3F

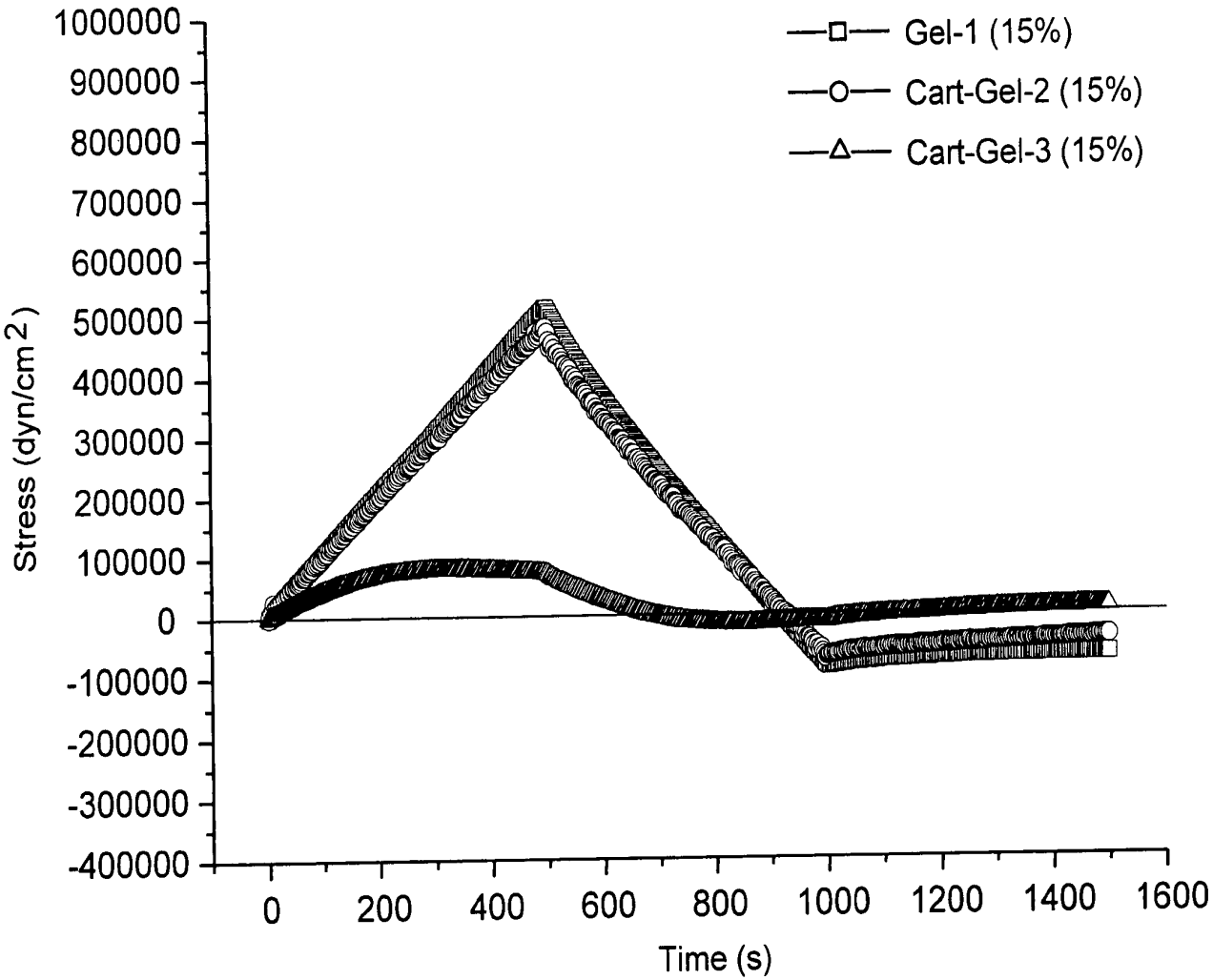
Gel-1 (15%)
Cart-Gel-2 (15%)
Cart-Gel-3 (15%)
Stress (dyn/cm2)
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
0
200
400
600
800
1000
1200
1400
1600
Time (s)

FIG.3G

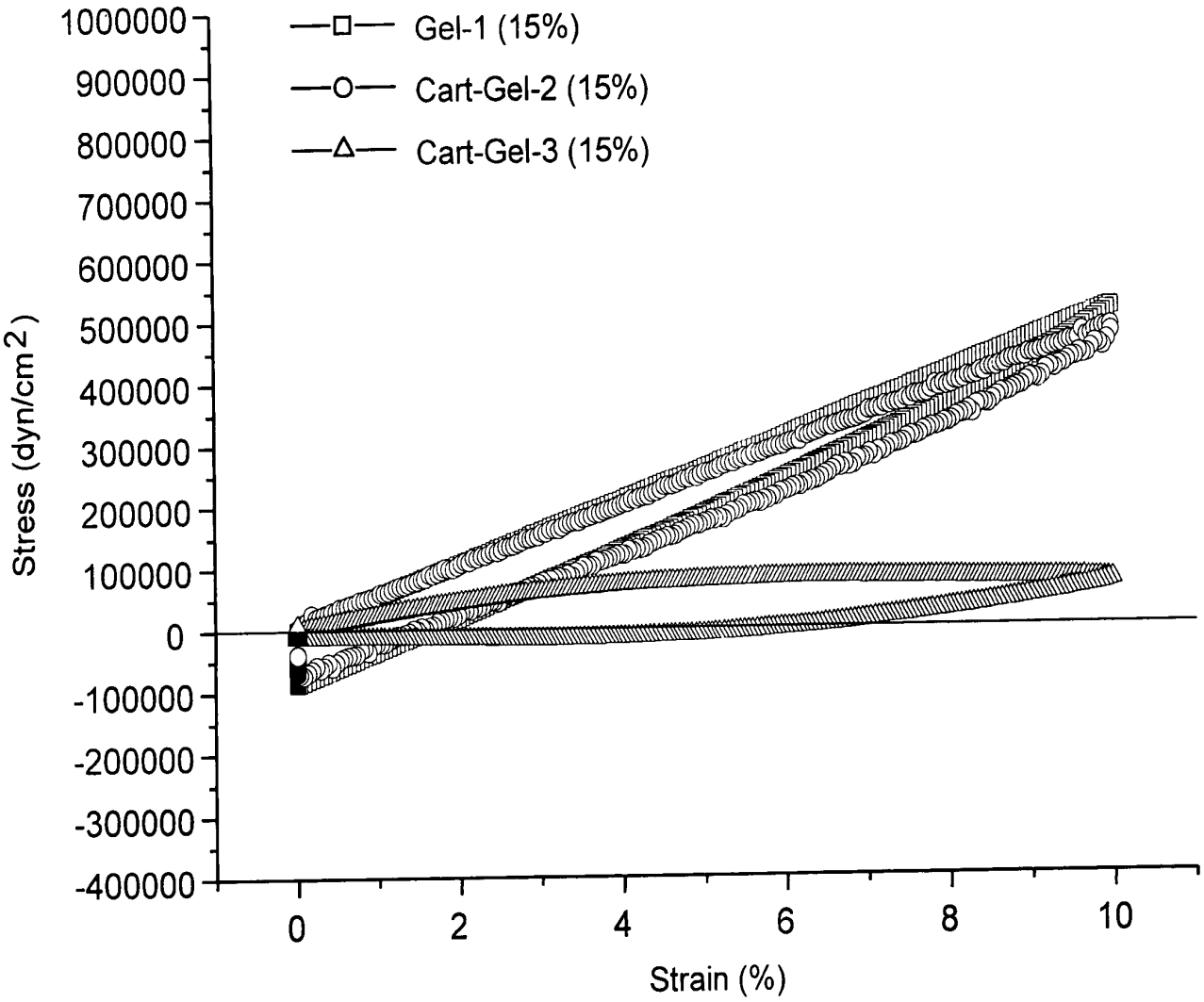
Gel-1 (15%)
Cart-Gel-2 (15%)
Cart-Gel-3 (15%)
Stress (dyn/cm2)
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
-100000
-200000
-300000
-400000
0
2
4
6
8
10
Strain (%)

FIG.3H

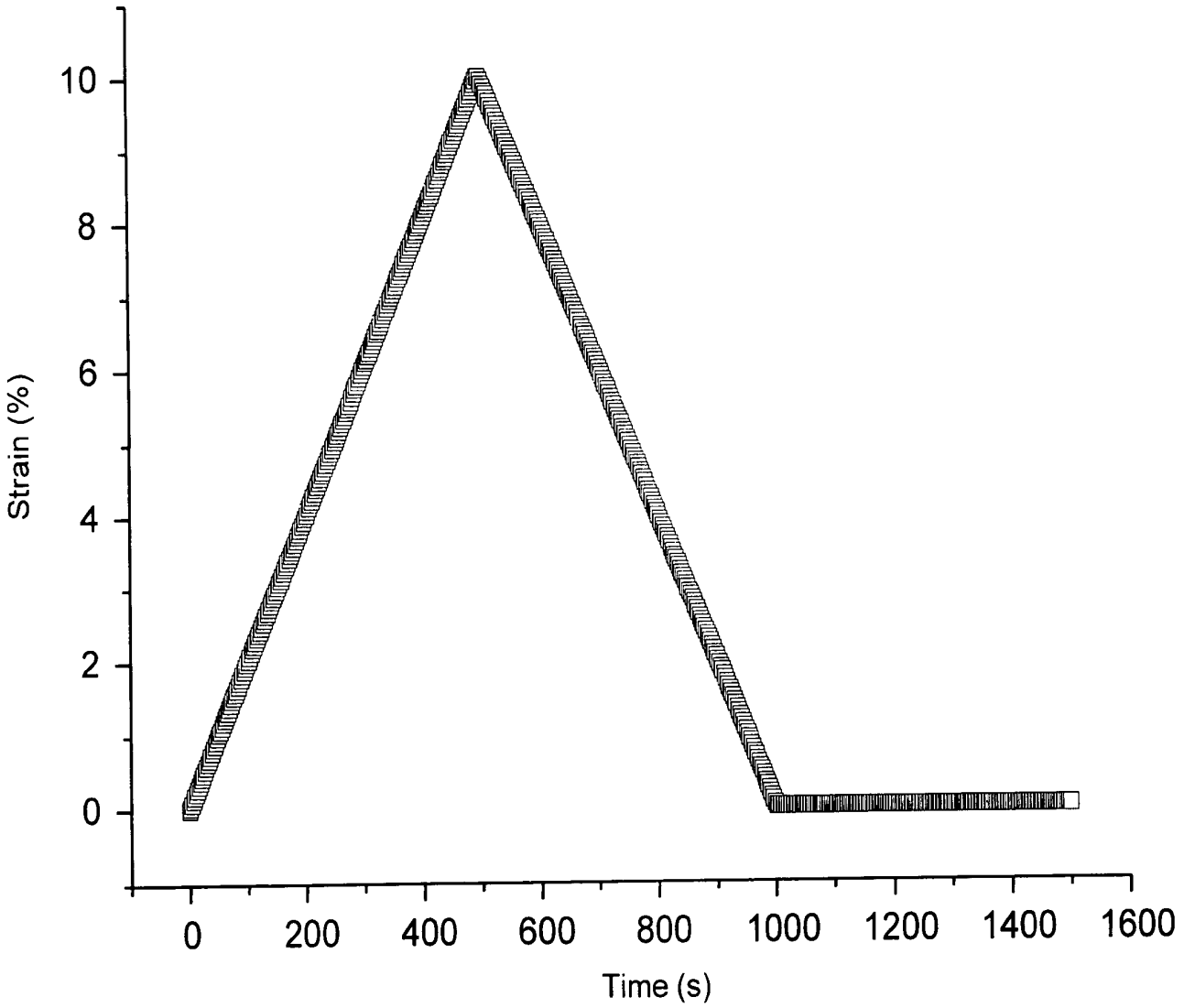

FIG.3I

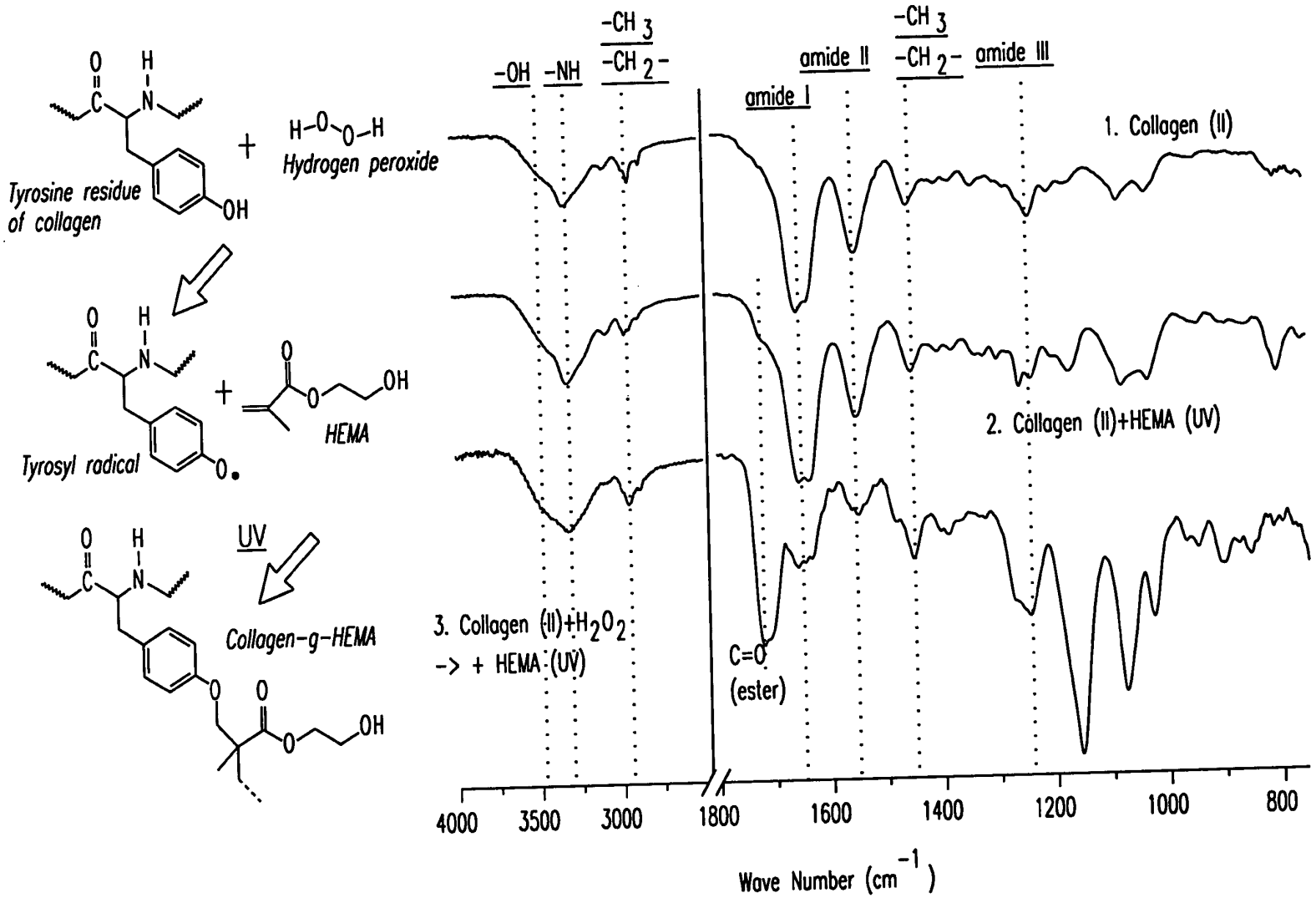
Tyrosine residue of collagen
Hydrogen peroxide
Tyrosyl radical
HEMA
UV
Collagen-g-HEMA
-OH
-NH
-CH 3
-CH 2-
amide I
amide II
amide III
1. Collagen (II)
2. Collagen (II)+HEMA (UV)
3. Collagen (II)+H2O2 -> + HEMA (UV)
C=O (ester)
4000
3500
3000
1800
1600
1400
1200
1000
800
Wave Number (cm-1)

FIG.4

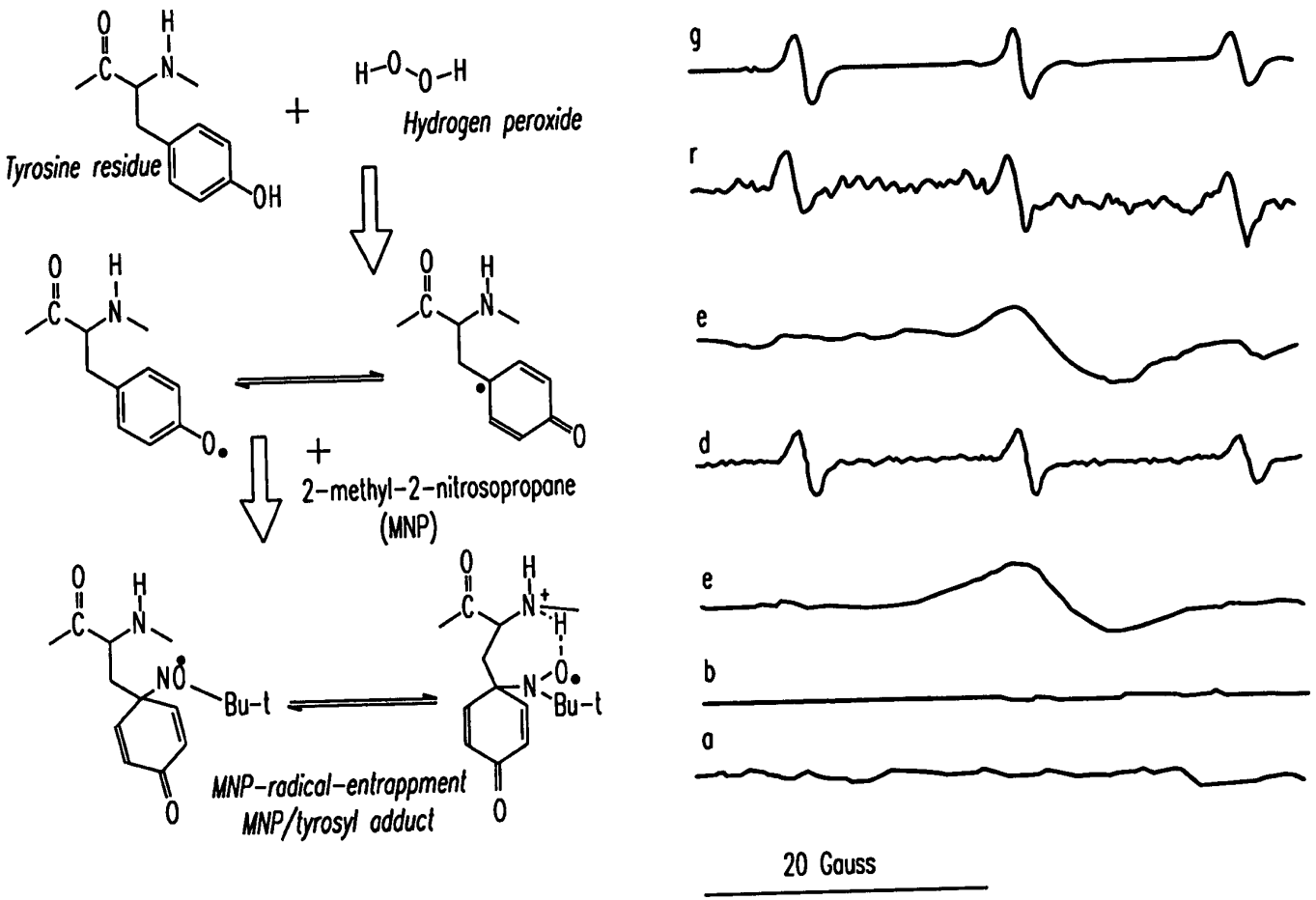
Tyrosine residue
OH
H-O-O-H
Hydrogen peroxide
2-methyl-2-nitrosopropane
(MNP)
NO
Bu-t
MNP-radical-entrappment
MNP/tyrosyl adduct
g
r
e
d
e
b
a
20 Gauss

FIG.5

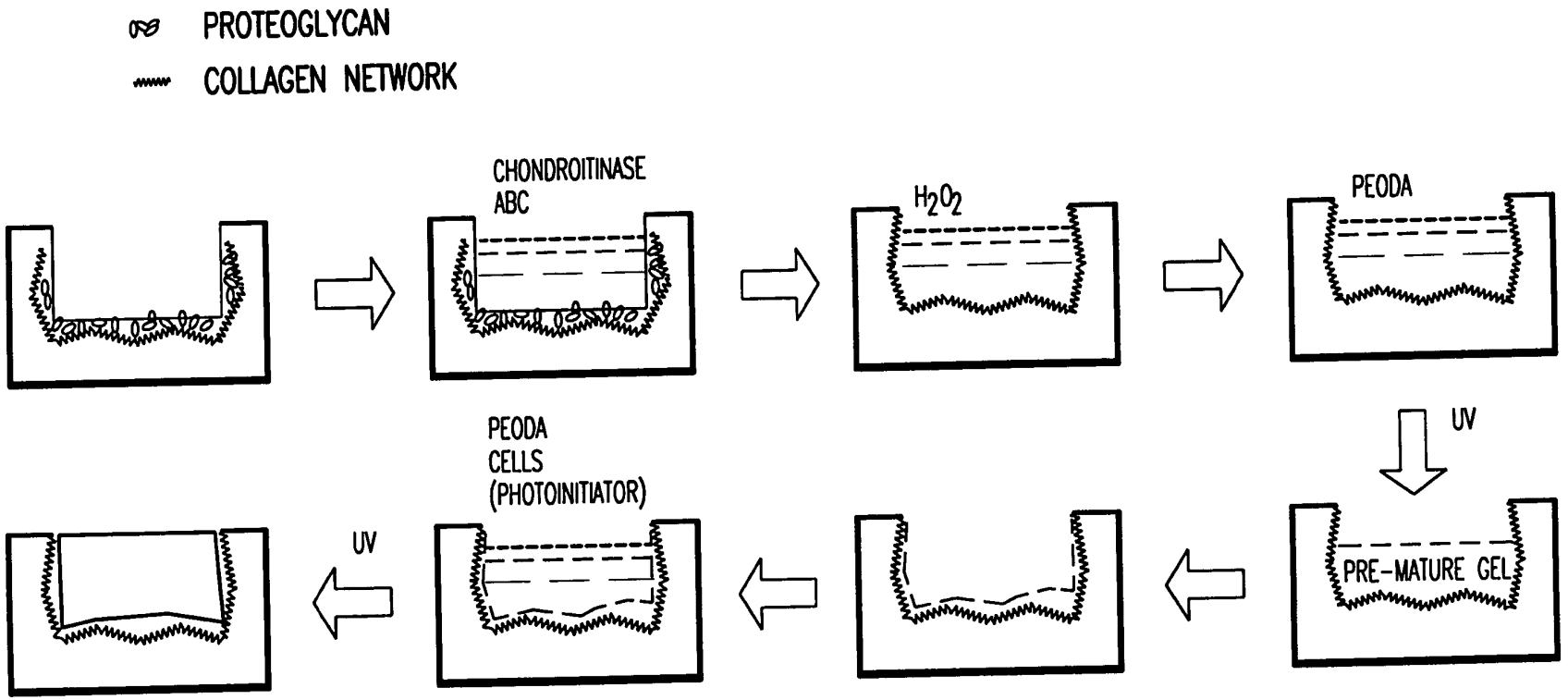
PROTEOGLYCAN
COLLAGEN NETWORK
CHONDROITINASE ABC
H_2O_2
PEODA
UV
PRE-MATURE GEL
PEODA CELLS (PHOTOINITIATOR)
UV

FIG.6

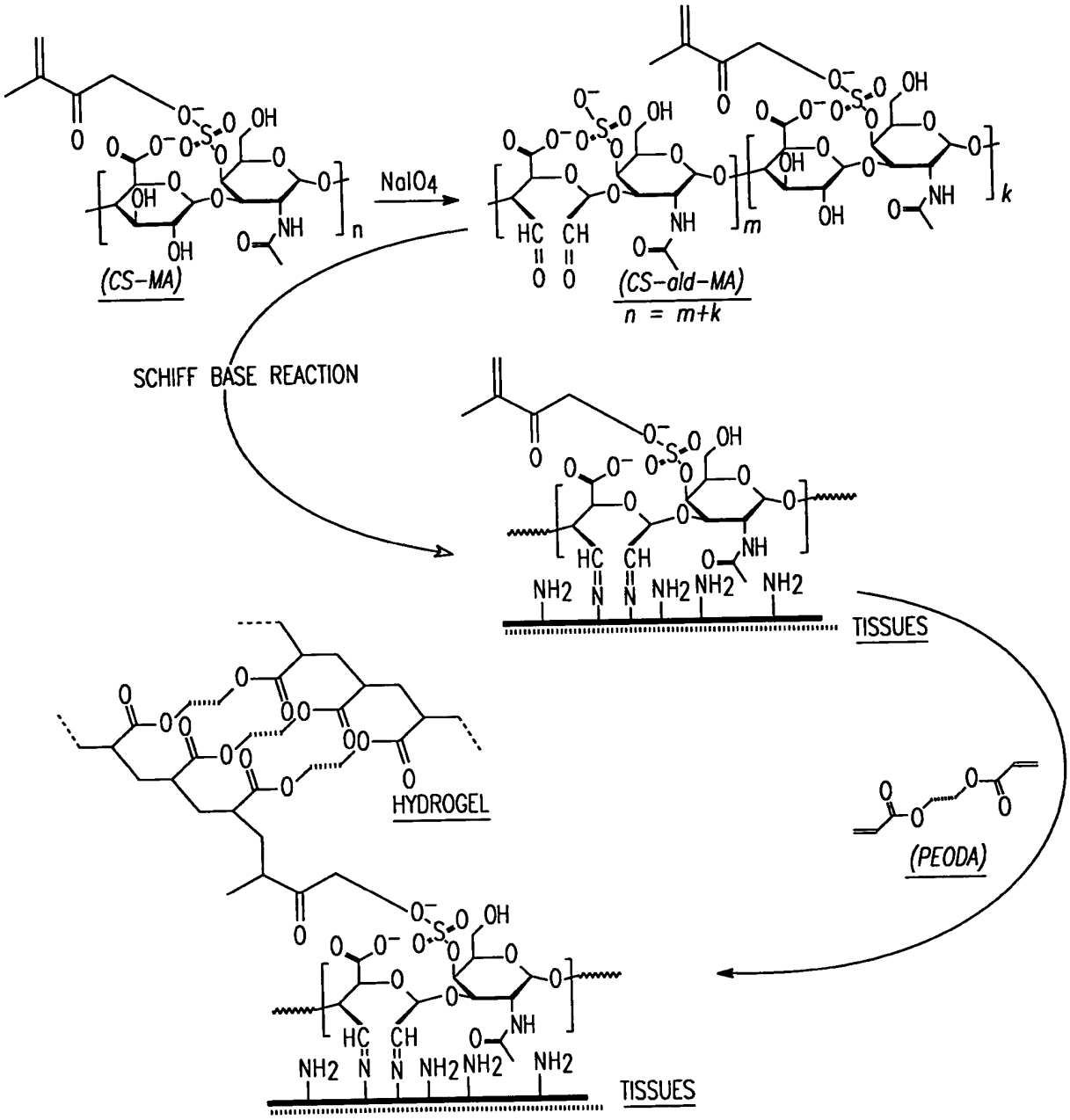
NaIO4
(CS-MA)
(CS-ald-MA)
n = m+k
SCHIFF BASE REACTION
TISSUES
HYDROGEL
(PEODA)
TISSUES

FIG.7